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## PROFESSOR MACH'S PHILOSOPHY.

**A**MONG our contemporary thinkers Prof. Ernst Mach is distinguished by independence and exactness of thought and an absolute absence of pretension which with all his prominence in the history of science renders him pretty nigh one of the most amiable men in the world. He has crowned his life's work by a new volume, entitled *Cognition and Error*,\* in which he discusses methods of scientific enquiry and points out the sources of error. Professor Mach is original in the sense that he does not rely on others but goes his own way. He has been influenced by great thinkers in both philosophy and physics, but he has not become the disciple of any one of them, and we would say that the main points on which he insists are, first, his distinction between theory and fact, and secondly, his observation of the *modus operandi* of science itself which he finds in an economy of thought. This economy leads to simplification finally implying a system of monism, and in this sense Mach may be called one of the leading monists whose theory, however, is tentative and empirical, not dogmatic or metaphysical.

Mach's aim from the beginning has been to eliminate the many errors and implications that arise from a wrong conception of our intellectual tools. Theories are frequently regarded as the main thing, and facts as incidentals,—in consequence of which theories are looked upon

\* *Erkenntniss und Irrthum*. Leipzig: J. A. Barth, 1905.

as ontological principles and constitute the basis of all metaphysicism which has been dominating in both philosophy and science.

As soon as I became acquainted with Mach's works, I at once recognized in him a kindred spirit, and my admiration has only increased by personal acquaintance. I am proud to count him among my dearest personal friends. There are no doubt differences between Mach's views and mine, but they are due, so far as I can see, to Mach's (in my opinion exaggerated) anxiety not to lose in his science from under his feet the *terra firma* of concrete facts.

Professor Mach looks, so far as I can see, with too much suspicion upon theories in every form, and compares them to the scaffolding of a building in erection. The scaffolding has to be taken down, as soon as the building is completed. He further criticises the mechanistic view,—that theory which would resolve all the different sciences into mechanics,—as insufficient and one-sided, a proposition to which I agree but not without considerable modification and for other reasons than his as well as with different objections.

I had some controversies on these points with Professor Mach, but I have not succeeded either in converting him to my view, nor have I been convinced by his reply. I had hoped at any rate for a mutual understanding by which our disagreement would either be reduced to verbal differences, or its source and significance be discovered, but in some way or another I have not succeeded, and our readers might deem it an open question whether there are points in which I have misunderstood Professor Mach, or whether in spite of all agreement, we face a radical difference in our philosophical conception.

Now Dr. Kleinpeter, one of the most ardent and most accomplished disciples of Professor Mach, presented a condensed statement of Professor Mach's monism, in the

April number of *The Monist*, and I find that in pointing out the uniqueness of Professor Mach's standpoint, he includes among others my own philosophy as noticeably different from his. Whether or not this is so ought to be decided by Professor Mach himself, but being anxious to understand him, as well as to point out why and how I differ from him, I wish to devote to this important subject a few comments.

I have always endeavored to work out a philosophy that should be objectively acceptable to all as much as is any science. Philosophy as a science, or in other words the philosophy of science, is the great desideratum of the present age. In order to attain my aim I have carefully endeavored to eliminate the personal equation which philosophers so easily introduce into philosophy by their ambition for originality. At the same time I have tried to understand other philosophers, not in their errors according to literal interpretations, but in the truth which they intended to bring out. The intention of a philosophy is its spirit, and many drawbacks in the systems of the past are due to awkwardness, perhaps also to the fact that standpoints have been taken in contrast to errors of their age, and I find, when trying to be just toward other philosophers, that there is more agreement in the philosophical world than is generally thought. Even in my present differences with Professor Mach, I still feel the confidence that we mean the same, and where I may appear radically opposed to his views, especially as understood by Dr. Kleinpeter, I am convinced that Dr. Kleinpeter is only not sufficiently familiar with my exposition, and that he misunderstands it because he does not fully appreciate the object which I have in view, and which, so far as I can see, is only more comprehensive than are Mach's expositions, and will help to explain his theories on the economy of thought. On the other hand, Dr. Kleinpeter insists,

as it seems to me, more vigorously than Mach himself on those points which I deem the weak spots of Mach's views.

Dr. Kleinpeter makes too much of a passage in Mach in which, with reference to the difference between the reasoning of the philosopher and the scientist, he speaks not without irony of the fortunate position of the philosopher who possesses unshakable principles, while the naturalist considers even his best-founded views as provisional.

Dr. Kleinpeter claims it as quite original for Mach that to him there is only one kind of reasoning. Though there are a few philosophers who think that there is a difference between philosophic and scientific cognition I do not think that either Aristotle or Kant would have made that distinction; and as to myself I will in this connection call attention to a controversy I had with Professor Jodl on this subject\* in which some years ago I insisted on the very same point, and claimed that there was no philosophical reasoning different from that of the scientist. Like Mach, I go further and claim that the scientist's view is nothing but common sense only more refined by exactness and punctilious attention to detail. More than that, all thinking is but the conscious tracing of the processes which build up the subconscious foundation of our mind, being kin to other natural phenomena not only in the animal world but even in inorganic nature.

Dr. Kleinpeter italicizes the statement that "Mach's monism is not a monism of system, but a monism of method." If this is meant in contrast to all other conceptions of monism, including my own, I wish to call his attention to the fact that this is an important point I have been insisting on since I have become a defender of the unitary world-conception. I will only make one quotation

\**Surd of Metaphysics*, pp. 101-115. Republished from *The Monist*, II, pp. 235-238.

which I select from my *Primer of Philosophy* (Introduction, p. 4) where I say in almost literal agreement: "Monism is not a finished system, but a reliable plan for a system." I have always rejected all those monistic conceptions which would establish a unity of the world by reducing it to one abstraction, either of matter, or of spirit, or of any other generalization. I have taken pains to explain that all these abstract ideas are not realities, but thoughts (abstract generalities), and that the unity of the world has to be derived from that obvious feature of experience which allows the methodical systematization of knowledge. Whether or not the world consists of one substance or possesses also an external unity, is another question of which I deem an affirmation probable but as yet unproved. The main thing is that there is no duality in the conception of the world, and all truths must finally form one consistent system of truths. If there is any difference between Mach and myself, I might claim having paid even more attention to this particular point, and having more vigorously insisted on it, than he.

Professor Mach's monism is the result of his methodology, and his methodology is based on the experience that science is economy of thought. I agree perfectly with him on this subject, and I believe that he has not had a more appreciative reader of his expositions than myself. He has treated this particular subject with an unprecedented mastery, yet it would be a mistake to say that he is the only, or even the first, scientist who has recognized this point. Mr. Thomas J. McCormack has collected a number of remarkable passages from Adam Smith on the very same subject\* which prove that consciously and unconsciously other people have had the same thought. It is perhaps natural, and most assuredly interesting, that an economist should be more appreciative of the value of

\* "An Episode in the History of Philosophy," *The Open Court*, IX, 4450.

economy of thought than philosophers, but it is sufficient to prove that the idea is not as unique as Dr. Kleinpeter thinks, although I am fully convinced that the way in which Mach handles the subject proves the originality of his mind.

While I have no objection to Mach's description of science as economy of thought, I would hesitate to say that it is sufficient as a definition, because science is a correct (or adequate) description of facts in their essential features. Exactness, correctness, adequacy, truth, or whatever you may call it, is the main thing, and comprehensiveness comes in second as a natural consequence whenever the essential features have been rightly understood. Economy of thought again is due to comprehensiveness; and so in our conception economy of thought, which undeniably is a significant characteristic of science, can by no means be regarded as a sufficient description of science, or even its most essential quality.

We are told by Dr. Kleinpeter that "it is characteristic of a system that it begins in some slight self-evident proposition and descends from these to particulars," and that "Mach's method" is "exactly the reverse." Since the term "system" is also meant for my conception of monism, I wish to call Dr. Kleinpeter's attention to the first chapter in my *Fundamental Problems*, on "Ontology and Positivism" in which I point out the contrast of my monistic positivism to Hegel's ontology. While Hegel starts from the abstract and comes down to the concrete, I start from the concrete and explain the nature of the abstract as having risen from concrete facts. And our abstractions have been invented for nothing else (as Schiller once declared) than to give us a survey over the domain of facts.\*

The difference between myself and Professor Mach

\*For the elucidation of this point, I translated and quoted Schiller's splendid little poem "The Metaphysician" in *Fundamental Problems*, p. 77.

as to the part which economy plays in the realm of thought is mainly this: that while Professor Mach appears to rest satisfied with using it as a principle that has so far worked well in experience, I try to explain why economy of thought is possible at all, and my explanation is based on the idea that theory is not a purely subjective device to deal with experience, but that there is a feature in experience itself which justifies the formulation of theories. This feature is conditioned neither by energy nor by matter (which are the abstract terms for the concreteness of the world as experienced by resistance), but it is of a purely relational, i. e., a purely formal, nature. The purely formal is characterized by an absence of concreteness, a negative feature which, however, (as is the case with all negative magnitudes) is not without a positive application. In my articles on mathematical space I have defined it as "any-ness," which implies generality, and experience proves that the generality of the purely formal can be relied upon in the domain of concrete objectivity. Accordingly the purely formal is not merely a matter of method, it is not purely subjective, but must be a feature of the objective world.\* It explains why there are uniformities. In other words the purely formal (Kant's *a priori*) is not as Kant says purely "ideal," but it is also objective. Numbers, curves and other *a priori* constructions can be employed as systems of reference for determining features in analogous instances of experience.

This is a justification not only of the objectivity of form and formal relations, but also of their correct representation in the purely formal sciences (Kant's *a priori*). It is more than likely that Professor Mach would object to the term *a priori*. Nevertheless he accepts confidence in it for *a priori* means nothing but beforehand knowledge, i. e.,

\* For details I must refer to the articles in question, "The Philosophical Foundation of Mathematics," *The Monist*, XIII, 273; "The Foundations of Geometry," *ibid.*, 370, 493.



the possibility of knowledge in certain lines of argument by reflection, pure thought, mere theory (call it by whatever name you please) even before we have had an experience thereof. Such is Kant's own explanation as stated in the beginning of the *Critique of Pure Reason*.

Professor Mach (as quoted by Dr. Kleinpeter) speaks of the essence of science as "a means by which we are spared direct experience." That is an unequivocal recognition of the *a priori* as a working principle.

There are two kinds of theories, first such elucidations of a group of unexplained facts as render it intelligible by comparing it to another group of facts that is well understood. The theory of an electric fluid is a good instance. Such theories are mere scaffolds which (as Mach suggests) will have to be taken down as soon as we know the actual state of things. They are mere similes, helpful so long as we know no better, but they may become hindrances to progress if not distinguished from facts. However, there is another class of theories which consists of uniformities, viz., generalized descriptions of groups of facts, and they are not merely temporary scaffolds, they are the real stones of the building of science itself.

According to Professor Mach there is no difference between purely formal and material, between *a priori* and *a posteriori*, and I shall possibly agree with him in the sense in which he means it, for I do not deny that ultimately everything is derived from experience. Yet there is a contrast between the purely formal and the material; there is a difference of method between purely mathematical investigations and chemical experiments. Much depends on words, for we may or may not limit the term "experience" to sense-experience only.\* The truth remains that all mathematical and logical truths are the results of an inner experience called reflection, and in performing purely

\* Compare my *Primer of Philosophy*, p. 26 ff.

formal operations we omit all reference to either matter or energy, the main features of objective reality, and limit our attention to the purely relational.

While purely formal thought constitutes a field of its own, I have insisted on the fact that it does not stand in contradiction to experience. Sense-perception and the purely formal sciences are ultimately derived from the same source. The latter are purely mental constructions, yet the principles and general conditions of mathematics, including geometry and algebra, logic, etc., have been quarried, as much as sense perceptions, out of the mine of experience. There is nothing that has not, directly or indirectly, been derived from experience, but the characteristic feature of the purely formal sciences in contrast to the natural sciences resting on sense-perception is exactly this,—that the former are purely mental constructions built up in the abstract domain of anyness. I grant that mathematics is absolutely true only in the field of its own premises (mathematical space), but there is in it a feature which makes it universally applicable, and we have only to modify it by considering the special conditions to which it is applied.

Further, does not Dr. Kleinpeter exaggerate the significance of Mach's proposition that "sense-perceptions, not objects, are the subject-matter of the scientist?" Is not the definition of object as a bundle of sense-perceptions widely accepted? The first sentence in the chapter entitled "Definitions and Explanations" in my *Fundamental Problems* (p. 254) states the same truth as follows: "The data of experience are perceptions." It is quite obvious that the difference between the psychologist and the naturalist is merely, as Mach says, a difference of standpoint, or as I would express myself, a difference of the object in view, a difference of purposes.

In spite of these agreements between Professor Mach

and myself I know of some differences—especially those concerning which we had some controversy. Professor Mach regards the whole of reality as sense-perception, and deems the distinction made between objects and sense-impressions inadmissible. To him sense-impressions contain the whole of reality, and science has nothing to do but to analyse and elucidate sense-perceptions. It seems to me that there must be here a difference of nomenclature, and I would think that Professor Mach in speaking of the sense-perception of a star, includes with it the star itself and the whole immeasurable depth of celestial space which according to our scientific knowledge the light of the star has to travel. Professor Mach has informed me that such is not his view. His idea of sense-perception is simply sense-perception and nothing more.

Professor Mach explains the origin of his views in a footnote on page 23 of his *Contributions to the Analysis of the Sensations* where he says:

“I have always felt it as a stroke of special good fortune, that early in life, at about the age of fifteen, I lighted, in the library of my father, on a copy of Kant’s *Prolegomena zu jeder künftigen Metaphysik*. The book made at the time a powerful and ineffable impression upon me, the like of which I never afterward experienced in any of my philosophical reading. Some two or three years later the superfluous rôle played by the “thing-in-itself” abruptly dawned upon me. On a bright summer day under the open heaven, the world with my ego suddenly appeared to me as *one* coherent mass of sensations, only more strongly coherent in the ego. Although the actual working out of this thought did not occur until a later period, yet this moment was decisive for my whole view. I had still to struggle long and hard before I was able to retain the new conception in my specialty. With the valuable parts of physical theories we necessarily absorb a good

dose of false metaphysics, which it is very difficult to sift out from what deserves to be preserved, especially when those theories have become very familiar to us."

Mach's book *Contributions to the Analysis of the Sensations* is the result of the experience here related. If the whole world consists of sensation, the work of science can only be an analysis of sensations.

Without finding fault with Professor Mach's views, I would say that I prefer to state the same truth in a different way. Professor Mach speaks of "sensations" as "the elements of the world," while I call "sense-perceptions" "the data of experience." I do not hesitate to say that the data of experience (i. e., the sum total of our sensations) is the basic portion of our subjective existence, and the rest of it, our ideas, abstract thoughts, etc., is a mental construction built from the material furnished by sensations. The domain of thought has been worked out to serve as a picture of the objective world, or in other words it is meant to denote the conditions which determine the different states of our subjective existence. Professor Mach thinks that sensations alone are real and that our ideas are purely mental symbols, but I beg to differ. I am perfectly aware of the subjective nature of our mental constructions, but I claim that they have objective validity. They are not purely subjective reconstructions of what we call things and the interrelation of things. I endorse Mach fully when he describes our thoughts as an imitation or remodeling of the facts (*ein Nachbilden der Thatsachen*) but I would not limit the meaning of the word "fact" to sensations, which alone are said to be real and the elements of the world. I would include under the term also and especially those objective factors which we assume to be the external causes of our sensations. Whether or not things are such as we conceive them to be is not the question here. We only say that things as they appear to our

senses give evidence of a reality not ourselves which we call objective; and our mental picture of this reality may be correct or incorrect, true or false, adequate or inadequate, according to our power of verifying our anticipations. If I see an after-image and try in vain to take hold of it with my hand, I conclude that the after-image is an illusion, which means that I deny its reality. If I have a wrong idea concerning the nature of certain things, my anticipations will be disappointed, and I shall have to grant that I was mistaken. But if my anticipations do not disappoint me, the object is called real. If my calculations based upon exact observations prove reliable, I am entitled to think that they were correct. Truth is adequacy of representation with reference to the thing represented, and the only test of truth to be had is a justification by experience.

One characteristic feature of experience is a general consistency of facts which may popularly be expressed in the statement that nature is uniform. The uniformities of nature, commonly called natural laws, do not contradict one another.

Mach's definition that sensations are "elements of the world" is true from the subjective standpoint, but our own experience teaches us that the subject originates and passes away. The elements of the subjective world are not the elements of the objective world, though we may say that the elements of our knowledge of the objective world are sensations, or better sense-impressions, made upon the subject by an unknown reality. Mach's definition of "sensations" as "the elements of the world," is a misnomer; he ought to define it as "the elements of *our* (i. e., the subject's) world."

We would further say that the data to be analysed are not exactly sensations but perceptions. It is a well-known psychical truth that man is not conscious of the sense-

element of his sensations, but of the result such as it appears when worked out by the mind. This result of sense-impressions is called perception. If I see a sparrow seated on the window sill, I do not see a little brown speck on my retina, but I see a gray bird; in other words, I am conscious of the result and not of the elements into which a psychological and physiological investigation analyses my perception. And this is so true that our sense-perceptions are sometimes vitiated by ideas associated with kindred sense-impressions. Hallucinations or counterfeit perceptions are produced with such vividness that the sensation is forever afterward adulterated by its association, so as to render a reliable analysis of its recollection absolutely impossible.

I have never lost sight of the truth that not things, but our perception of things, are the data of experience. To me this proposition is a tautology, for it simply means that the world of our subjectivity is subjective. But for that reason I would not say that the world itself is subjective too. While "*our* world" is made up of sense-elements, "*the* world" is different, and in contrast to subjective existence we call it "the objective world."

It is a traditional fault of idealists (who, however, had better be called subjectivists) to identify the subjective world with the entire world including its objective aspect. One of these idealists is Schopenhauer, and through him I became for the first time intimately acquainted with idealism. Idealists as a rule when understanding the truth of the proposition that our world consists of sensations, forget that the idealist view is one-sided and must find its completion in a proper comprehension of the nature of the objective world.

The contrast is well described by Schopenhauer, who characterizes Goethe as a realist (or we had better say "objectivist") incapable of understanding the subjectivism

of Schopenhauer's idealism. Schopenhauer met Goethe at Weimar, and mentions the following incident:

"This Goethe is so entirely a realist that he could not get it into his mind that objects as such existed only in so far as they were conceived by the thinking subject. 'What,' said he once to me, gazing at me with his Jupiter eye, 'light should only be here in so far as you see it? No sir. You would not be here if the light did not behold you.'"

Obviously both Schopenhauer and Goethe are right, and each one expresses one aspect of the truth. Objects, *qua* objects, are mere bundles of sensations and the objective world as it is conceived by man's mind is a picture woven of sensation and thought. So far Schopenhauer is perfectly right, but that something which is represented by these sensations is not a mere dream. It is what is commonly called reality or the objective world, and this objective world is the foundation from which the subjective world is a mere temporary and transient reflection. Accordingly, Goethe is right (just as much as Schopenhauer) when he contends that man and his eye would not exist unless the light did behold him and thereby had produced his vision. Schopenhauer means by light a psychological function, while Goethe means an objective process, viz., the ether waves which produce those wonderful color sensations on our retina. The eye would never have developed in a world without ether waves.

That Goethe was neither so one-sided nor so philosophically crude as Schopenhauer thought, appears from his well-known aphorism:

"Were not the eye to the bright sun akin,  
It never could the light see shine,  
And did not God dwell thus our soul within,  
How could with rapture thrill us the divine?"

"Wär' nicht das Auge sonnenhaft,  
Die Sonne könnt' es nie erblicken.  
Läg' nicht in uns des Gottes eigen Kraft,  
Wie könnt' uns Göttliches entzücken!"

I am faced by the dilemma that either Mach has strained a point and we must not take him seriously, or that he is an idealist or, as we would say, a subjectivist.

The other point where I cannot follow Professor Mach is his objection to mechanicalism. I must confess that I myself am not a supporter of the mechanistic theory of the world in the sense in which Professor Mach criticizes it. There are philosophers and scientists who believe that the whole world can finally be explained by matter and motion, and that all the sciences can ultimately be resolved into mechanics. This proposition in my opinion can not be maintained. Still I believe that all motions can be mechanically explained. The mechanical theory applies strictly and without exception to any process in the objective world that is a change of place, but it does not apply to other events such as belong to another domain of generalization. There is for instance no way to explain mechanically a feeling, or an idea, or a sentiment. I can explain the physiology of sensation as a commotion in the sense organs and nerves, but not the feeling; and the simple reason is that feelings and ideas are no motions, and can not, in consequence, find a mechanical explanation.\*

Mach confesses that a perusal of Kant's *Prolegomena* made a powerful impression on him, but I do not know how it influenced him in the formation of his own thought, for nowhere in Mach's writings have I found a discussion of Kant's problem of the *a priori*. To Mach there is no *a priori*; to him the purely formal sciences are as empirical as physics and the other natural sciences. And yet he recognizes the existence of the *a priori*, in that he grants that by science we are spared direct experience. How is it possible that we can know anything if not through direct experience? Mach discovers *that* it is possible, and I have undertaken to show *why* it is possible.

\* For further elucidations see for instance *Soul of Man*, pp. 16-22.



This world of ours with which we become acquainted by experience is a peculiar mixture of two features which seem contradictory. It consists of innumerable sense-impressions picturing as many events or objects, all particular, all individual cases, each one different from the other, a wonderful chaos of single items, an unlimited pluralism. And yet this chaos is amenable to classification by similarity, sometimes even sameness of form. We meet with classifiable types many of which constitute systems of classes and subclasses, like drawers containing boxes, all arranged in logical order as genera, species and sub-species. This systematization of experience is not a human invention but is part of the world itself. It is not an artificial device of the scientist, but it is the natural growth of mind which develops as unconsciously as a tree blossoms and bears fruit. Its regularity is due to the same norm that conditions the regularity of a snow crystal or the regularity of the petals of a flower.

The immediate outcome of this classification results in the development of man's mind in the faculty of generalization, implying a wonderful economy in the household of thought and the almost magical ability of anticipating experience. This is the problem of before-hand knowledge commonly styled the *a priori*.

The problem of reason, which is identical with the problem of the nature of universals, as well as the *a priori* was well formulated for the first time, but not correctly solved, by Kant. To him reason, i. e., the whole machinery of purely formal thought, in other words, all *a priori* knowledge of any kind, is "ideal," i. e., our categories of thought and also our conceptions of time and space are mental constructions, while the data furnished by experience (our sense-impressions) are real. This is the climax of nominalism which denies the reality of universals and looks upon them as mere names (*nomina*) or, as scientists to-day

would say, "mere theories." There is nothing real in them save the breath of the voice (*flatus vocis*) that utters them.

Nominalism is the denial of an old and inveterate error of science, viz., the thingish reality of universals, which would be well characterized as a belief in philosophical mythology. We have seen what a prominent part the universal plays in the formation of man's mind, and we can not wonder that universals (especially those of practical importance) have been deified as Zeus and Athena, as Poseidon, Hades and Persephone, etc., and even the sages of antiquity who recognized at once the incongruities of mythology which treated universals as persons, nevertheless looked upon them as realities not unlike moulds which existed somewhere in the workshop of God. Such is Plato's doctrine of ideas which exist above time and space in the realm of eternity. The mediæval school that insisted on the reality of universals is called "realism" (which of course must be well distinguished from modern realism) and, establishing itself firmly in the Church as well as all great institutions of learning, it succeeded in crushing nominalism. While victorious realism became ossified in dogmatism, nominalism led a miserable existence among heretics, but proved the more vital of the two, leading up to modern science with its denial of universals in any shape.

Kant drew the last consequence by relegating all theory, anything universal and *a priori*, to the thinking subject. His idealism does not deny the reality of the objective world but claims that its order together with all laws of nature has been transferred to it by the thinking subject. Form and formal laws appertain to the latter not the former, leaving the former, the objective world, the object, the sum total of things, in itself unknown and unknowable.

Kant does not deny the objective validity of the purely formal; he only denies its reality. To him, time, space and the categories, including causality, are merely subjective,

but being inalienable features of the thinking subject, they are to every thinking subject universal and necessary, so that we can not help viewing everything through these mediums.

Mach's position is similar in many respects. He denies the reality of universals and suffers theory merely as a makeshift, as a scaffolding, temporarily erected for tentative simplification of a description of facts. Our sense-perceptions alone are real to him. Everything else, as for instance the concepts of atoms and other notions of physics, is to him a device to facilitate an analysis of sense-perceptions and to trace the interconnection of their elements.

In criticism of these views I claim that while nominalism was right in objecting to the doctrine of realism which hypostatized universals, realism was right in insisting on their reality. In other words, while our formulation of universals is subjective, there is an objective feature in the world which corresponds to them and so justifies their construction. This objective feature is form.

Form is typically objective, and it is subjective only because the thinking subject is at the same time an object moving about, like all other objects, in the objective world. The subject has constructed systems of conceptions, analogous to the forms of the surrounding world. Hence their agreement is a matter of course. There is no need of transferring them to the objective world; for they were there, before we were, and our mind together with its reason and purely formal sciences is a result of their presence in the cosmos of which we are a part.

The laws of form are universal, and mind develops (as everything else) on account of them. The cosmic order is due to the regularity of form, and the ideal construction of the laws of form in the shape of arithmetic, geometry, logic, etc., are simply a tracing of necessary results derived

from actions (such as counting and measuring) in the domain of anyness.

By anyness I understand a mental field emptied of all particularity so that its abstract emptiness is homogeneous in any of its parts and a sameness prevails throughout for any construction. In reality, i. e., in the aggregation of things, viz., the objective world, there is no such a thing as absolute homogeneousness, for every point in space and time is different from any other, and even if we assume that there was a time in which the aboriginal world-stuff was homogeneous, every particle of it was individual and different from all others, by position as well as by being itself and not its neighbor. In a certain sense you may say that anyness is an assumption of science, or if you prefer, a fiction, but there is a feature in reality that corresponds to it which we call form. It is understood that there is no form in itself, any more than there is matter in itself, or energy in itself, or anything in itself. But form as a feature of reality is as real as matter and as actual as energy. Considered by itself (which can be done by abstraction) it is empty, i. e., void of particularity, and thus it possesses that indifference which makes it applicable to any case, but the very anyness of this empty abstraction constitutes its great use in the domain of thought.

Kant's fault is that he identifies "the ideal" (i. e., the domain of thought, forms or ideas) with the subjective; hence his idealism is after all (in spite of his protests) subjectivism. Still he recognizes the validity of the laws of pure form in experience, and truth is to him not, as to the realist, an adequate representation of the thing but its consistent adaptation to the mind. Nietzsche, however, out-Kants Kant. His philosophy is nominalism with a vengeance. Truth is altogether abolished. It is denounced a fiction, nay a fraud. Logic becomes mere pedantry; consistency of thought, foolishness; and reason, a farce. Nor

does Nietzsche shrink from the last application of his denial of truth, for with its abolition he denies all difference between good and evil, right and wrong, and the higher man is not he who is nearer to truth and actualizes it in his life by doing right, but he who possesses more brute power and uses it by ruthlessly treading his fellow beings under his foot.

Is Mach's philosophy truly a mere revival of nominalism? We would be obliged to say so if it is a matter of principle with him that all theory stands condemned as mere fiction whose utility is purely temporary.

Mach points out that the method of explanation is by resolving the unknown into terms of the known, thus rendering the known familiar to us. This is true to some extent, but not altogether. The savage is familiar with the fact that fire consumes sticks of wood and sees no miracle in their disappearance. But the scientist can not be satisfied with mere familiarity. He weighs and counts and wants everything that makes its appearance or disappearance accounted for. He is not satisfied until he knows what has become of the sticks that have been burned and how the ashes originate. The scientist looks upon the world as a system in which the sum total of substance\* and energy is constant, while the form is subject to change. He deems an event unexplained until he can trace the transformation that has taken place.

Transformations are changes of place, or motions. Therefore the ideal of science will always be to reduce all physical phenomena, all the transformations that occur in space, to motions, and thus we try to render molecular

\*We say substance, not matter as is customary when speaking of the law of the conservation of matter and energy. By matter we now understand bodily reality analyzable into its chemical elements, and the term is frequently used in contrast to ether. Naturalists have of late been forced to the conclusion that matter is not eternal but that it is formed by condensation from a thinner substance which we have good reason to identify with the ether. The word "substance," being more general than "matter," would be more correct in the present connection.

changes comprehensible by thinking of them as minute motions. We do so because we can not help it, for in fact we can not even conceive of a transformation of anything except by a new adjustment of its parts which involves a change of place or motion. Mach looks upon this ideal of physical science as illegitimate and as an illusion. He believes that we happen to be best familiar with motions and therefore only mechanical explanations are most satisfactory to us. But if we assume that we were better familiar with electrical phenomena or with some others due to molecular changes, we would try to explain mechanical processes by comparing them to electrical phenomena.

There is a truth in Mach's proposition; it is this, that the unknown becomes more familiar to us by association with the known. We become accustomed to it as when a stranger is introduced to us by a friend. But to be familiar with an occurrence and to comprehend it are two different things. A full comprehension comprises not only a knowledge of all the details of a transformation, the description of a series of causes and effects, but also the reasons (commonly called laws of nature) which sum up the salient features of a whole class of phenomena in a general formula.

When Mach says there are no causes, and when Kirchhoff drops the term *Ursache* from his definition of the science of mechanics, they do so because they have in mind a wrong conception of cause. The words cause and reason have their very good use in language, but since time immemorial philosophers have confused both terms, and have mystified the world with their errors. Such phrases as "*causa sui*," "first cause" and "final cause," are evidences of the general confusion. By *causa sui* Spinoza means the most comprehensive reason which needs no explanation; he does not mean a cause at all. "First cause" is a misnomer for "ultimate *raison d'être*," and "final

cause," for "purpose." Kirchhoff was satisfied to define mechanics as a terse and exhaustive description of motions,\* and he is right; but his descriptive formulas of typical cases are exactly the reasons why a certain motion takes place in such or such a way. Galileo's law simply formulates the salient feature of the rate of acceleration in falling bodies, and Newton's law describes the function of gravitation. In other words laws of nature are (as Clifford said) uniformities.

And among the uniformities of nature, the mechanical descriptions have not accidentally become the most important ones which merely appear to be most helpful to us because we are most familiar with them. I can imagine that there are sentient beings in whom electrical or chemical senses predominate. The senses of touch, motory sense, and sight, are prominently mechanistic, being quick to observe and trace motions and mechanical changes of form. In dogs and fishes the sense of smell is marvellously well developed, and there might be animals who rely mainly on, or are adapted to perceive, thermic, electric, or other phenomena. Yet I venture to say that no chemical or electric sense could out of itself and without the assistance of either sight or motor sense have developed mind and reason. Man became man because he moved about, because he observed motions and learned to adjust his own motions. The mechanistic conception of processes renders them comprehensible. The world would remain obscure to us if we had to classify things according to odors. In fact living beings begin their career as animals of smell, but in the progress of evolution the eye and the hand develop, which organs serve best the mechanistic function of comprehension, while the olfactory lobes degenerate. I am prepared to say that reason is, if not al-

\* See the author's *Grund, Ursache und Zweck*, Dresden, 1881; *Fundamental Problems*, pp. 88-91; *Primer of Philosophy*, pp. 138-143.

together, yet most assuredly in a great and indispensable part, the product of the mechanistic interpretation of nature.

Professor Mach is quite positive in his opposition to the mechanistic conception of the world, but I have never been convinced by him.

I grant that a mechanical description of physical happenings is only a one-sided method of comprehending reality. Nay, I would go further and say that any scientific treatment is insufficient to exploit all the values of experience. Besides the intellectual interpretation of the world, we have others that can not be determined either in the balance or by the tape measure. The mystic's point of view is under certain restrictions quite legitimate, and at any rate the artist's interpretation is recognized as proper even by the larger number of scientists. However, though other viewpoints have their right, and though in their way they are apt to cover features of reality which are inaccessible to an exact valuation or computation, the methods of science will always remain indispensable and are unique in their way.

While I grant that universals are mere generalizations, and theories mere devices of science to render groups of phenomena intelligible, I yet insist at the same time that there are features in the objective world which correspond to them. Plato's conception of eternal types (the Platonic idea) is not wrong, if we make allowance for some mythological expressions. So, generally, man's conception of truth though a mental picture reflects, in so far as it is correctly worked out, an objective feature of reality. The same holds good of space and time and the purely formal sciences. Our space and time conceptions are mental constructions and some of their features are purely mental, but the relational is a factor in the objective world, and indeed it is the main factor in all processes of transforma-



tion. Any one who will take the trouble to apply my method of interpretation to the history of human thought, including the history of religion, will find much truth in error, for what at first sight seems like a string of superstitions becomes a systematic approximation in exactness of statement, and so we learn that the old chaff of tradition was not without its grain of truth.

If I appear in contrast to Mach in a reactionary light, I have held to my view not without weighing the pro and con of his standpoints, and with all due reverence to Professor Mach's prominence and fame, I must continue to hold my own, not because they are my own, but because they include all the truth propounded by Mach. I know why Mach halts, for I go beyond him and explain his views.

The points where I seem to differ from Mach (so far as I understand the situation) are exactly a recognition of the truth which will set his most helpful thoughts into a clearer light. My solution of Kant's problem will explain Mach's principle of the economy of thought and show how economy of thought originates, and why it is valid in experience, i. e., why it can be applied and relied on as a method of scientific inquiry.

Mach is a great scientist, and it is peculiar to him that unmindful of others he has pursued his own way even to isolation. As a thinker he stands by himself, and there is a gulf between him and his predecessors. Wherever his thought coincides with the thought of others, we may be sure that he arrived at the result in perfect independence, and Kleinpeter goes so far as to describe his views as contradictory to the general traditions and makes the contrast more pointed than it really is. I see in Mach a necessary and indeed healthy and extraordinarily successful phase in the development of the philosophy of science. While Kleinpeter emphasizes Mach's position in contrast to his predecessors too much, because he fails to see that there is

a truth also on the other side, I believe that a recognition of the truth as seen from the other side will lift Mach out of his isolation and will set his favorite ideas in a worthy frame.

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It seems probable to me that Professor Mach will deem my philosophy reactionary. When he sees that I recognize some truth in views which he has discarded, he will think that I have fallen behind, and march in the rear of of progress. This at any rate appears to be the impression which my writings have made on Dr. Kleinpeter. I can calmly leave the decision to posterity, and will only say here that for similar reasons I appear reactionary to many freethinkers who blame me for not joining their chorus in denouncing all religion as superstition. It is natural that he who endeavors to avoid one-sidedness will appear over-conservative to the radicals and over-radical to the conservatives.

I am the most radical among the radicals, and yet I am more truly conservative than most of the leading orthodox churchmen. I recognize no limitations, I owe no allegiance and feel under no obligations: I am willing to take the consequences of truth whithersoever it may lead. I go beyond the agnostic, who in my conception is a half-hearted thinker that does not care to be of his own opinion. He denies but does not endorse his denial and leaves it an open question, throwing the burden of responsibility upon his opponent, daring him to make the affirmation. What the agnostic deems unknowable is non-existent. There is not *such a* God, *no such* soul, *no such* immortality as he questions. But while I myself frankly deny the mythology of our traditions both in science and religion, I am not prepared to discard their meaning. I would teach mankind not to abandon their ancient conceptions of truth, but to reinterpret them, or to restate them, unencumbered with

mythology. Myths are truths poetically expressed; but negations are void of truth. The thoughtless have always found it easier to believe in the letter than in the spirit and so superstitions were unavoidable. Negations, doubt and unbelief are desirable for the sake of preparing reforms, but progress is not in them. Progress moves in affirmations, even though they are temporarily dressed up as myths and act as superstitions. The myths and parables of the past are preliminary surrogates which are insufficient approximations of the truth, and so the ideas, God, soul and immortality will remain, but the current views will have to be replaced by conceptions that are better, nobler and truer.

What is true in the history of religion is true also in the evolution of science. The old views are not quite so useless as they may appear to the iconoclast of radical reform.

EDITOR.